

photographs showing much detail. Possibly these might require special treatment.

Formulæ might be given for each plate for converting the réseaux coordinates into absolute selenographical coordinates, but the former would be more convenient for identification and for reference.

There are other questions which would also engage the attention of such a committee as has been proposed. Professor Shaler, writing as a "geologist and geographer," \* has expressed the opinion that the present system of nomenclature is crude and inadequate ; that the analogies suggested are often misleading ; and that many of the more important features, such as capes, have been left unnamed. He suggests the appointment of just such a committee as is now advocated to undertake possibly the revision, and certainly the extension, of the present system.

Professor W. H. Pickering, again, has urged † that the existing names have been unfortunately allotted ; that in many cases large and important areas have received the names of men who have done little for selenography, or even for astronomy, whilst many men who should be really commemorated are represented by small and insignificant craters. It is probably too late to alter this, but the criticism might well be considered by the committee.

*On a New Method of Determining the Moon's Position photographically.* By E. B. H. Wade, M.A.

(Communicated by Professor H. H. Turner.)

(1) Several methods have been proposed for determining photographically the Moon's position, either with a view to finding ephemeris errors or, given these, the longitude of a place. Amongst these methods we may mention that of Major Hills, R.E.,‡ in which a rigidly mounted camera is used to photograph the trails of suitable stars preceding the Moon, after which instantaneous exposures are made on the Moon itself, and finally further exposures are made for star-trails following the Moon. Again Professor Turner § has indicated a method of obtaining photographic transits which would be quite applicable to Moon culminations. Finally the same author has described || an extremely direct method in which the Moon is photographed amongst the stars immediately surrounding it. Over-exposure of the Moon's image relatively to the stars is avoided by

\* "A Comparison of the Features of the Earth and the Moon," *Smithsonian Contributions to Knowledge*, No. 1438, pp. 75, 76.

† *Harvard Annals*, vol. li. pp. 14, 15.

‡ *Mem. R.A.S.* vol. lxxii.

§ *Monthly Notices*, lvii. p. 349.

|| *Monthly Notices*, lxiv. p. 19.

drawing an opaque diaphragm furnished with a narrow slit across the Moon's image during the whole period of exposure.

With regard to the first method, although it has the merit of great simplicity, yet it is subject to the inconvenience that a complete set requires at least two hours' work. During the whole of this time the camera must remain immovable, and as the diurnal motion is uncompensated the exposures must be timed with extreme precision. As Professor Turner has pointed out,\* the methods of exposure on the Moon and stars are dissimilar, and this might lead to systematic errors. In any case the error in the deduced right ascension of the Moon is as great as the error in the time of exposure on the Moon.

With regard to the second method, it should be of a very high order of accuracy; but we are not, so far as I am aware, in possession of any actual results. I myself made some experiments in this direction in 1902, but was only partly successful, as I was employing a makeshift apparatus.

With regard to the third, if fog be successfully overcome it should enjoy all the accuracy of astrographic measurements. The method about to be described is put forward as an alternative one, and it is hoped to institute comparative experiments between the two.

(2) By means of double-image arrangements of mirrors it is possible to view the Moon in optical contact or proximity with stars which are in fact remote from it, and which in consequence are projected on a dark background. I have been working at intervals since 1901 November on methods of this kind, which are in fact extensions of the well-known method of observing the "lunar distance," and I have constructed an apparatus for *visual* observations on this principle, which is not yet, however, ready for publication. The object of the present note is to describe a photographic method by means of which the Moon's image is printed in the midst of stars at a distance of about  $15^\circ$  from it, so that all trouble from fog is avoided, and quite faint stars may be registered with instruments of small dimensions. All that is needed is an ordinary cœlostat and photographic camera; but the mirror of the cœlostat, instead of being worked to a true plane, is worked to a prism whose two faces are inclined at an angle of  $7\frac{1}{2}^\circ$ , and whose edge is parallel to the polar axis. When the camera is pointed at such an arrangement it can photograph two fields whose centres are distant from one another by  $15^\circ$  in right ascension. No apparatus not in ordinary use is necessary, except that a prism is substituted for the ordinary mirror.

(3) A camera is mounted at such a height that its optic axis passes horizontally through the centre of the mirror, so that one half of the object-glass is illuminated by one face of the prism and the other half by the remaining face. I arrange the circle of the cœlostat so that (for example) the preceding face of the

\* *Monthly Notices*, lxiv. p. 19.

prism projects the Moon's image in the centre of the field of the camera, and hold a sheet of white cardboard in front of the object-glass, to prevent any light entering the camera, while I draw the shutter of the dark slide. A semi-oval patch of moon-light is seen on the cardboard. The shutter of the plate-holder having been withdrawn, I move the cardboard laterally until the object-glass is uncovered, except for that half which is concerned in forming the Moon's image. The semi-oval patch of moonlight on the cardboard makes this operation easy. The card is held in this position during two and a half minutes; during the whole of this time the plate is receiving light from stars reflected by the following face of the prism, but none from the Moon. The cardboard is now moved sharply, so as to uncover the whole object-glass for a fraction of a second, and then restored to its former position. The exposure through half the object-glass is continued for another two and a half minutes. On development the plate is found to have registered an instantaneous photograph of the Moon in the midst of star images which have been exposed for five minutes, and have right ascensions differing by about one hour from that of the Moon.

(4) In the actual experiments the mirror of the cœlostat had a diameter of only four inches. The best lens which I had at my disposal was taken from a 2-inch visual achromatic telescope by Dallmeyer. On June 18 (when the Moon's age was fifteen days) in each of two consecutive exposures I secured eleven stars, none of them brighter than the magnitude  $6\frac{1}{2}$ , and there was no sign of fog. The method would therefore appear to repay trial on a larger scale. Out of the eleven stars the following were identified :—

15 Sagittarii.	82 Sagittarii.
16 Sagittarii.	$\rho^2$ Sagittarii.
21 Sagittarii.	

On the 19th I obtained :—

Preceding the Moon.	Following the Moon.
v Sagittarii.	i Capricorni.
$\rho$ Sagittarii.	30 Capricorni.
	31 Capricorni.

But I am not at the present moment sufficiently equipped with maps or catalogues to identify the remaining stars, which, however, are certainly fainter than magnitude  $6\frac{1}{2}$ . That they are really stars is certain; for, the clock of the cœlostat being imperfectly adjusted, each is represented by a short trail parallel to those of the identified stars. I have not as yet the necessary apparatus for making precise measures of these images.

(5) The question will naturally suggest itself: How far does precision depend on the adjustments of the cœlostat? The only

essential function of the cœlostat is to make the star images stand still during the five minutes of exposure. A fuller discussion of this point will be given later. For the present it is enough to say that if we take two photographs, in one of which the Moon's image is projected on a field of stars following it, and in the other on a field of stars preceding it, the small errors, due to adjustment, can be eliminated and the angle of the prism determined. Owing to the great constancy of the angle of a prism, it may be desirable to determine it once and for all from star images without the intervention of the Moon.

(6) I have in conclusion to tender my best thanks to Captain H. G. Lyons, R.E., Director-General of the Survey Department, for providing facilities for this work and sanctioning its publication.

*Helwan Observatory, Egypt :*  
1905 July 5.

NOTE.—Since the above was written I have obtained many other successful negatives with the apparatus described. The most interesting of these were taken in August in order to compare the ephemeris errors deduced with those given by the observations made at Helwan, Aswan, Edfu, and Chartas on the phases of the total eclipse of 1905 August 30.

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*Reproduction photographique des réseaux astrophotographiques.*  
By Henry Bourget.

i. Les astronomes qui ont manié des réseaux tracés sur argent savent quelles précautions exige leur emploi et combien ils se détériorent rapidement. Les piqûres qui se forment dans la couche d'argent finissent, malgré les retouches, par les rendre inutilisables. Il faut acheter un réseau neuf, l'étudier et dresser le tableau de ses corrections. C'est une dépense et une perte de temps. Il serait très désirable d'en avoir de plus résistants et d'un usage, pour ainsi dire, indéfini. Un autre avantage d'un pareil réseau serait la possibilité de l'imprimer sur les plaques, au châssis-presse, par contact parfait. Ce serait à la fois plus commode et plus précis que le mode d'impression actuellement employé.

Un pas important a été fait dans cette voie par M. Izarn quand il a décrit dans le Bulletin de la Carte du ciel le procédé permettant de recouvrir la couche d'argent d'une couche mince de gélatine bichromatée insolée et par suite dans un état presque